Citation:

Dolan CM, Kraemer H, Browner W, Ensrud K, Kelsey JL. Associations between body composition, anthropometry and mortality in women aged 65 years and older. *Am J Public Health.* 2007 May; 97 (5): 913-918. Epub 2007 Mar 29.

PubMed ID: 1854878

Study Design:

Cohort study

Class:

B - Click here for explanation of classification scheme.

Research Design and Implementation Rating:

POSITIVE: See Research Design and Implementation Criteria Checklist below.

Research Purpose:

To examine the association between measures of body size and mortality in a predominantly white cohort of women aged 65 years and older who were participating in the Study of Osteoporotic Fractures.

Inclusion Criteria:

Women aged 65 years and older who were enrolled in the Study of Osteoporotic Fractures.

Exclusion Criteria:

Women who were black (because of their decreased risk for hip fracture), who had bilateral hip replacements or who were unable to walk with assistance.

Description of Study Protocol:

Recruitment

- Women aged 65 years and older were recruited from September 1986 to October 1988 through community-based listings in and around Baltimore, Maryland; Minneapolis, Minnesota; and Portland, Oregon and in the Monongahela Valley area near Pittsburgh, Pennsylvania
- Women were recruited from voter registration lists (Pennsylvania and Minnesota), driver's license and identification card holders (Maryland) and health maintenance organization (HMO) membership lists (Minnesota and Oregon).

Design

Cohort study.

Dietary Intake/Dietary Assessment Methodology

- Lean mass was estimated from bioelectrical impedance analysis (BIA) as 0.470 x ($Height^2$/Resistance) + (0.170 X Weight) + (0.03xReactance) + 5.7
- Fat mass was calculated as the difference between total body weight and lean mass
- Percentage body fat was fat mass expressed as a percentage of total weight.

Blinding Used

Not applicable.

Intervention

Not applicable.

Statistical Analysis

- Descriptive statistical analyses were performed to identify potential confounding variables for inclusion in multivariate models
- For continuous variables, analysis of covariance was used to estimate age-adjusted means and standard deviations among survivors and among those who died during follow-up
- For categorical variables, percentages were adjusted to the age distribution of the entire cohort (N=8,029) at visit two by the direct method
- Pearson correlation coefficients were calculated to determine the correlations between the anthropometric main variables of interest
- Cox proportional hazards models were used to estimate the associations between anthropometric variables and rate of mortality
- Models were run for all women, adjusting for age only; for all women, adjusting for multiple potential confounders; and for non-smokers only, adjusting for multiple potential confounders
- The censor date was either the date of death or the end of the follow-up period. Each body size measure was included in a Cox regression model with a quadratic term because the association between each anthropometric measure and mortality was curvilinear. Proportionality assumptions of the models were checked by plotting the log (−log survival curves).
- Interaction terms between each body size measure and age were included, but no interactions were apparent
- The optimal value (nadir of the curve) 27 of each body size variable was stable in all age groups (66-69, 70-74, 75-79, 80-84 and age; 85 years), so all age groups were combined in the results presented here.
- We controlled for the effects of age by including it as a continuously distributed covariate. To depict the curvilinear associations between the body size measures and mortality, each body size measure was categorized into five equally-sized quintiles (on the basis of the distribution in the entire sample at visit two). Mortality rate ratios were calculated for each quintile relative to the lowest quintile.

Data Collection Summary:

- *Timing of measurements:*
  - 85% of the surviving cohort (N=8,082) completed a follow-up clinic visit at year two

(visit two) between January 1989 and January 1991 (when they were at least 67 years old)
    - Bioelectric impedance measurements were made only at visit two
- *Dependent variables:* Mortality
- *Independent variables:* Measures of body size
- *Control variables:* Not applicable.

Description of Actual Data Sample:

- *Initial N:* 9,704
- *Attrition (final N):*
    - 8,082 completed a follow-up clinic visit at year two (visit two)
    - 8,029 women who had complete bioelectric impedance measurements were included in the final study of lean mass, fat mass and fat mass percentage
- *Age:* 65 years and older
- *Ethnicity:* Mainly white
- *Other relevant demographics:* None specified
- *Anthropometrics:* None specified
- *Location:*
    - Baltimore, Maryland
    - Minneapolis, Minnesota
    - Portland, Oregon
    - Monongahela Valley area, near Pittsburgh, Pennsylvania.

Summary of Results:

Adjusted Rate Ratios (RRs; with 95% Confidence Intervals [CIs], by Quintiles of Body Composition Measures in Women Aged 65 Years and Older

		Lean Mass	Fat Mass	Percentage Body Fat	Body Mass Index	Waist Girth
Age-adjusted RR (95% CI)						
First quintile		1.0	1.0	1.0	1.0	1.0
Second quintile		0.75	(0.62-0.91) 0.71 (0.59-0.85)	0.78 (0.65-0.94)	0.74 (0.61-0.89)	0.79 (0.64-0.99)
Third quintile		0.67 (0.55-0.82)	0.58 (0.48-0.71)	0.70 (0.58-0.85)	0.62 (0.51-0.75)	0.84 (0.68-1.05)
Fourth quintile		0.67 (0.55-0.82)	0.65 (0.53-0.79)	0.60 (0.49-0.74)	0.65 (0.53-0.79)	0.98 (0.79-1.20)
Fifth quintile		0.87 (0.72-1.06)	0.81 (0.67-0.99)	0.84 (0.69-1.01)	0.86 (0.71-1.04)	1.09 (0.88-1.34)
Multivariate-adjusted RR (95% CI)						

First quintile		1.0	1.0	1.0	1.0	1.0
Second quintile		0.88 (0.72-1.080)	0.80 (0.66-0.98)	0.88 (0.73-1.07)	0.80 (0.65-0.96)	0.87 (0.69-1.09)
Third quintile		0.83 (0.67-1.08)	0.67 (0.54-0.83)	0.77 (0.63-0.94)	0.70 (0.57-0.87)	0.93 (0.75-1.17)
Fourth quintile		0.88 (0.70-1.09)	0.72 (0.58-0.89)	0.65 (0.53-0.82)	0.72 (0.58-0.89)	1.10 (0.88-1.36)
Fifth quintile		1.16 (0.92-1.45)	0.93 (0.75-1.16)	0.86 (0.70-1.06)	0.89 (0.72-1.10)	1.18 (0.94-1.47)
Multivariate-adjusted RR (95% CI)						
First quintile		1.0	1.0	1.0	1.0	1.0
Second quintile		0.88 (0.66-1.16)	0.71 (0.54-0.93)	0.89 (0.68-1.16)	0.94 (0.71-1.24)	1.05 (0.78-1.42)
Third quintile		0.78 (0.58-1.05)	0.74 (0.56-0.98)	0.77 (0.58-1.02)	0.83 (0.62-1.11)	0.88 (0.64-1.22)
Fourth quintile		1.06 (0.79-1.42)	0.80 (0.60-1.06)	0.64 (0.47-0.87)	0.81 (0.60-1.09)	1.14 (0.84-1.53)
Fifth quintile		1.32 (0.98-1.79)	1.04 (0.77-1.40)	0.99 (0.75-1.32)	1.20 (0.90-1.60)	1.28 (0.94-1.75)

Author Conclusion:

Study findings do not support applying the NIH categorization of BMI from 25-29.9kg/m^2 as overweight in older women, because women with BMIs in this range had the lowest mortality.

Reviewer Comments:

Research Design and Implementation Criteria Checklist: Primary Research

Relevance Questions

1.	Would implementing the studied intervention or procedure (if found successful) result in improved outcomes for the patients/clients/population group? (Not Applicable for some epidemiological studies)	Yes
2.	Did the authors study an outcome (dependent variable) or topic that the patients/clients/population group would care about?	Yes

3.	Is the focus of the intervention or procedure (independent variable) or topic of study a common issue of concern to nutrition or dietetics practice?	Yes
4.	Is the intervention or procedure feasible? (NA for some epidemiological studies)	Yes

Validity Questions

1.	**Was the research question clearly stated?**	Yes
1.1.	Was (were) the specific intervention(s) or procedure(s) [independent variable(s)] identified?	Yes
1.2.	Was (were) the outcome(s) [dependent variable(s)] clearly indicated?	Yes
1.3.	Were the target population and setting specified?	Yes
2.	**Was the selection of study subjects/patients free from bias?**	Yes
2.1.	Were inclusion/exclusion criteria specified (e.g., risk, point in disease progression, diagnostic or prognosis criteria), and with sufficient detail and without omitting criteria critical to the study?	No
2.2.	Were criteria applied equally to all study groups?	N/A
2.3.	Were health, demographics, and other characteristics of subjects described?	Yes
2.4.	Were the subjects/patients a representative sample of the relevant population?	Yes
3.	**Were study groups comparable?**	Yes
3.1.	Was the method of assigning subjects/patients to groups described and unbiased? (Method of randomization identified if RCT)	N/A
3.2.	Were distribution of disease status, prognostic factors, and other factors (e.g., demographics) similar across study groups at baseline?	N/A
3.3.	Were concurrent controls used? (Concurrent preferred over historical controls.)	N/A
3.4.	If cohort study or cross-sectional study, were groups comparable on important confounding factors and/or were preexisting differences accounted for by using appropriate adjustments in statistical analysis?	Yes
3.5.	If case control or cross-sectional study, were potential confounding factors comparable for cases and controls? (If case series or trial with subjects serving as own control, this criterion is not applicable. Criterion may not be applicable in some cross-sectional studies.)	N/A

3.6.	If diagnostic test, was there an independent blind comparison with an appropriate reference standard (e.g., "gold standard")?	N/A
4.	**Was method of handling withdrawals described?**	No
4.1.	Were follow-up methods described and the same for all groups?	No
4.2.	Was the number, characteristics of withdrawals (i.e., dropouts, lost to follow up, attrition rate) and/or response rate (cross-sectional studies) described for each group? (Follow up goal for a strong study is 80%.)	No
4.3.	Were all enrolled subjects/patients (in the original sample) accounted for?	No
4.4.	Were reasons for withdrawals similar across groups?	N/A
4.5.	If diagnostic test, was decision to perform reference test not dependent on results of test under study?	N/A
5.	**Was blinding used to prevent introduction of bias?**	Yes
5.1.	In intervention study, were subjects, clinicians/practitioners, and investigators blinded to treatment group, as appropriate?	N/A
5.2.	Were data collectors blinded for outcomes assessment? (If outcome is measured using an objective test, such as a lab value, this criterion is assumed to be met.)	N/A
5.3.	In cohort study or cross-sectional study, were measurements of outcomes and risk factors blinded?	Yes
5.4.	In case control study, was case definition explicit and case ascertainment not influenced by exposure status?	N/A
5.5.	In diagnostic study, were test results blinded to patient history and other test results?	N/A
6.	**Were intervention/therapeutic regimens/exposure factor or procedure and any comparison(s) described in detail? Were interveningfactors described?**	Yes
6.1.	In RCT or other intervention trial, were protocols described for all regimens studied?	N/A
6.2.	In observational study, were interventions, study settings, and clinicians/provider described?	Yes
6.3.	Was the intensity and duration of the intervention or exposure factor sufficient to produce a meaningful effect?	Yes
6.4.	Was the amount of exposure and, if relevant, subject/patient compliance measured?	Yes
6.5.	Were co-interventions (e.g., ancillary treatments, other therapies) described?	N/A
6.6.	Were extra or unplanned treatments described?	N/A

6.7.	Was the information for 6.4, 6.5, and 6.6 assessed the same way for all groups?	N/A
6.8.	In diagnostic study, were details of test administration and replication sufficient?	N/A
7.	**Were outcomes clearly defined and the measurements valid and reliable?**	Yes
7.1.	Were primary and secondary endpoints described and relevant to the question?	Yes
7.2.	Were nutrition measures appropriate to question and outcomes of concern?	N/A
7.3.	Was the period of follow-up long enough for important outcome(s) to occur?	Yes
7.4.	Were the observations and measurements based on standard, valid, and reliable data collection instruments/tests/procedures?	Yes
7.5.	Was the measurement of effect at an appropriate level of precision?	Yes
7.6.	Were other factors accounted for (measured) that could affect outcomes?	Yes
7.7.	Were the measurements conducted consistently across groups?	Yes
8.	**Was the statistical analysis appropriate for the study design and type of outcome indicators?**	Yes
8.1.	Were statistical analyses adequately described and the results reported appropriately?	Yes
8.2.	Were correct statistical tests used and assumptions of test not violated?	Yes
8.3.	Were statistics reported with levels of significance and/or confidence intervals?	Yes
8.4.	Was "intent to treat" analysis of outcomes done (and as appropriate, was there an analysis of outcomes for those maximally exposed or a dose-response analysis)?	N/A
8.5.	Were adequate adjustments made for effects of confounding factors that might have affected the outcomes (e.g., multivariate analyses)?	Yes
8.6.	Was clinical significance as well as statistical significance reported?	Yes
8.7.	If negative findings, was a power calculation reported to address type 2 error?	No
9.	**Are conclusions supported by results with biases and limitations taken into consideration?**	Yes
9.1.	Is there a discussion of findings?	Yes
9.2.	Are biases and study limitations identified and discussed?	Yes
10.	**Is bias due to study's funding or sponsorship unlikely?**	Yes

10.1.	Were sources of funding and investigators' affiliations described?	Yes
10.2.	Was the study free from apparent conflict of interest?	Yes